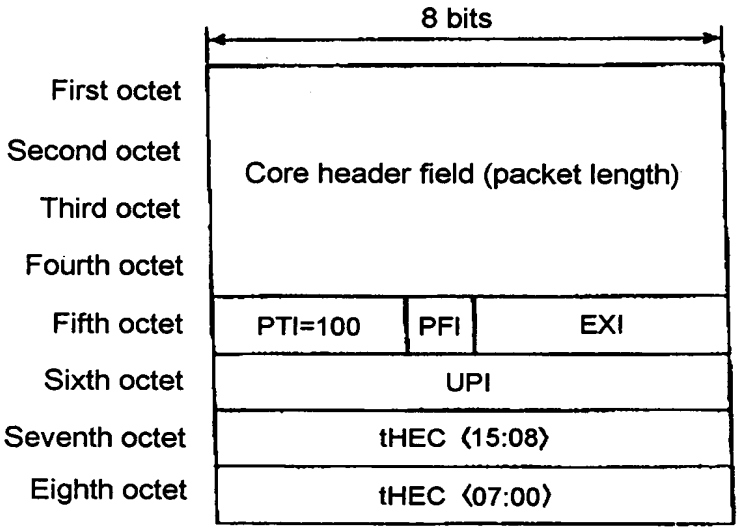


Field name	Value	Explanation
PTI (Payload Type Identifier)	100	Client management frame
PFI (Payload FCS Identifier)	0	No payload FCS
EXI (Extension Header Identifier)	0000	Null Extension Header Type
UPI (User Payload Identifier)	0000 0001	Client line fault (LOS)
	1000 0000	Client line fault (Link-down)

FIG. 1 (BACKGROUND ART)

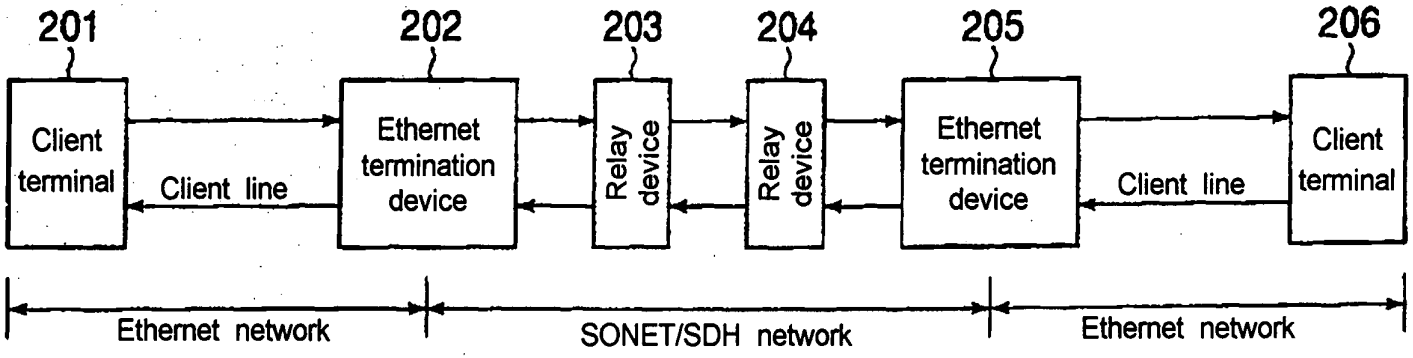


FIG. 2 (BACKGROUND ART)

FIG. 3A

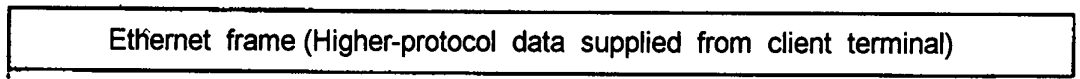


FIG. 3B

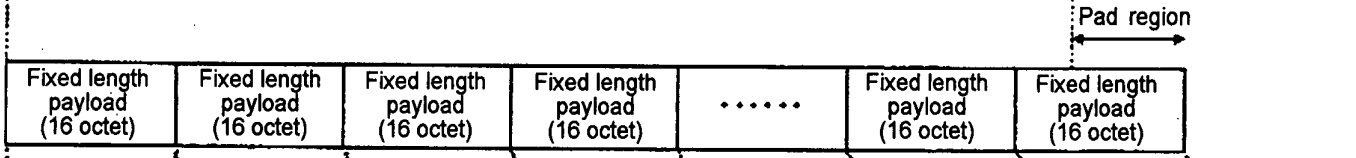


FIG. 3C

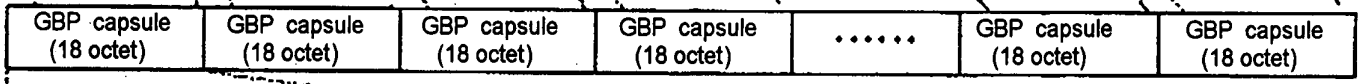


FIG. 3D

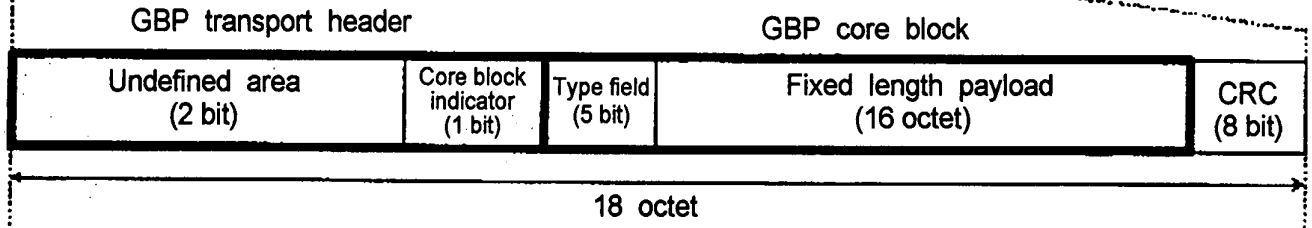
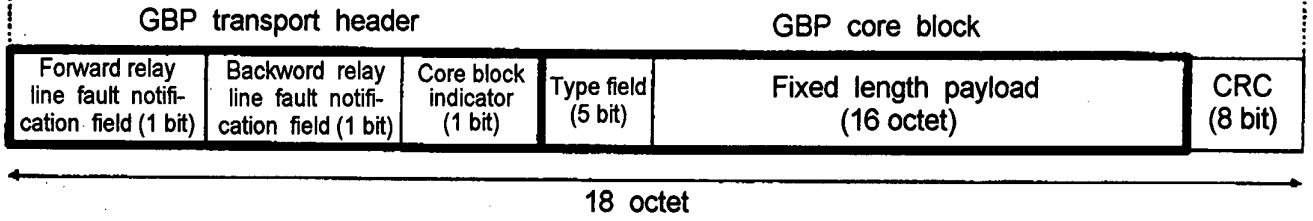


FIG. 3E



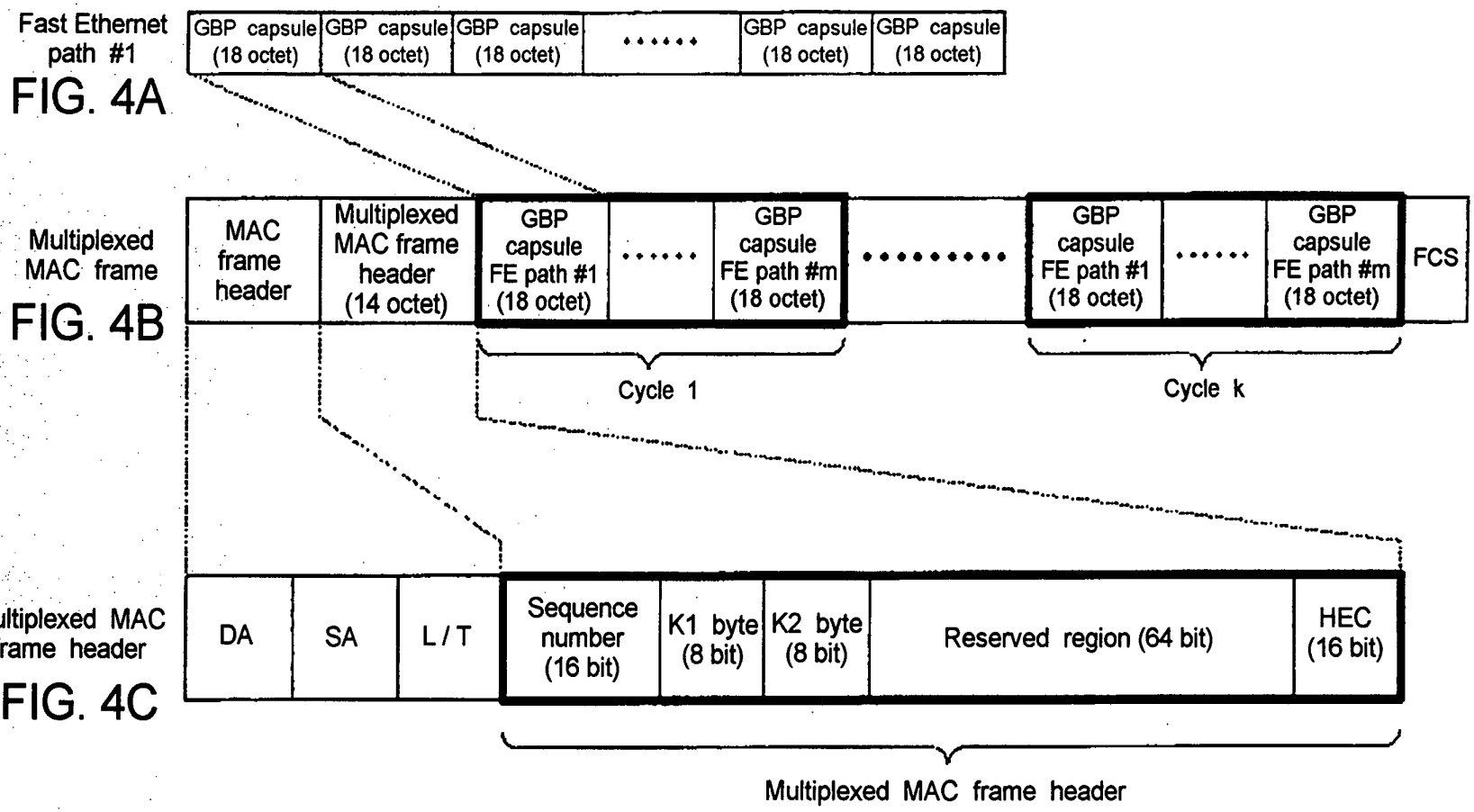


FIG. 4A

FIG. 4B

FIG. 4C

Fast Ethernet path #1

FIG. 5A

GBP capsule (18 octet)	GBP capsule (18 octet)	GBP capsule (18 octet)	.....	GBP capsule (18 octet)	GBP capsule (18 octet)

Fast Ethernet path #1

FIG. 5B

Fixed length data (1 octet)	Fixed length data (1 octet)	Fixed length data (1 octet)	Fixed length data (1 octet)	Fixed length data (1 octet)	Fixed length data (1 octet)	.....	Fixed length data (1 octet)	Fixed length data (1 octet)	Fixed length data (1 octet)	Fixed length data (1 octet)

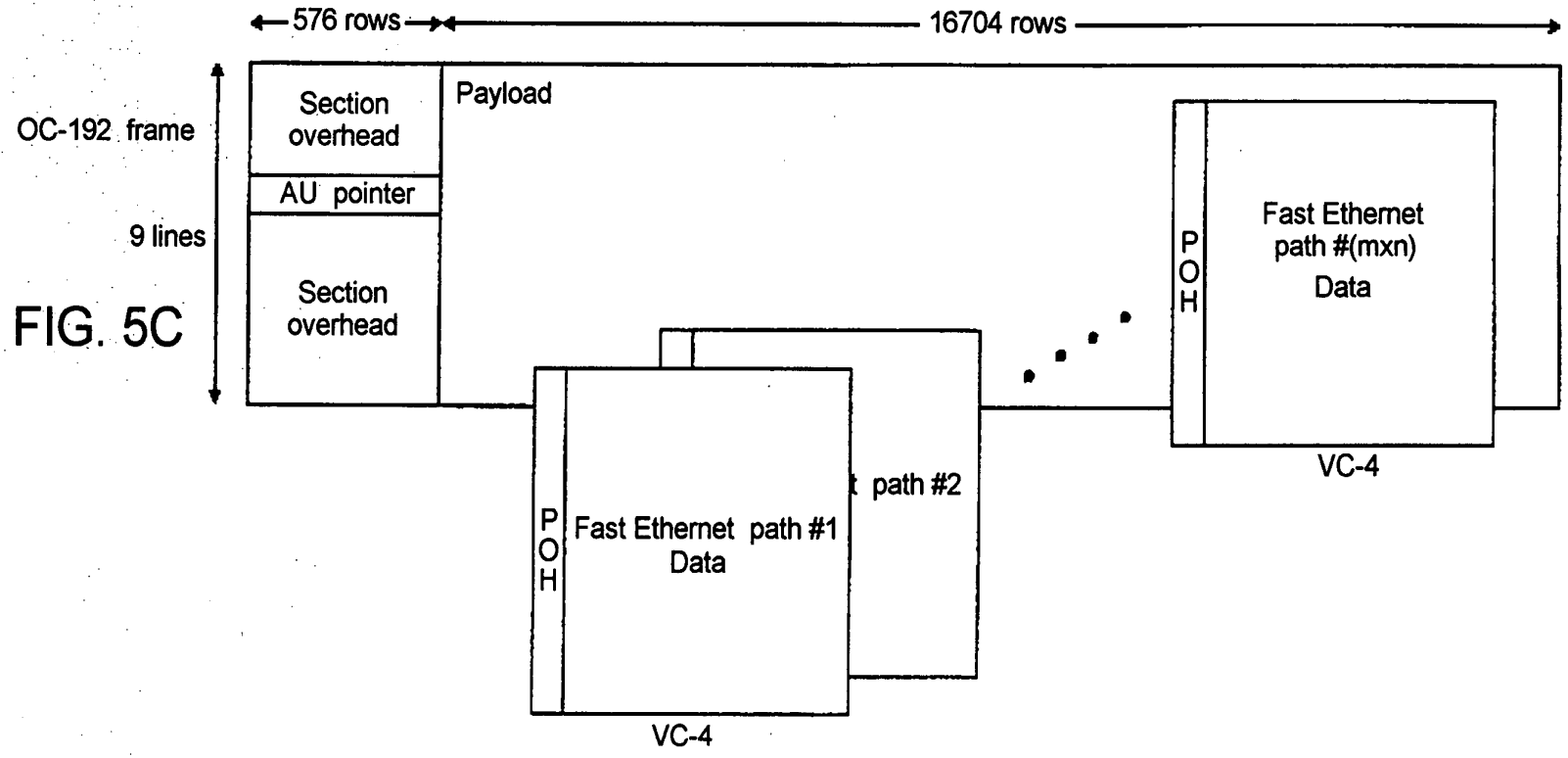


FIG. 5C

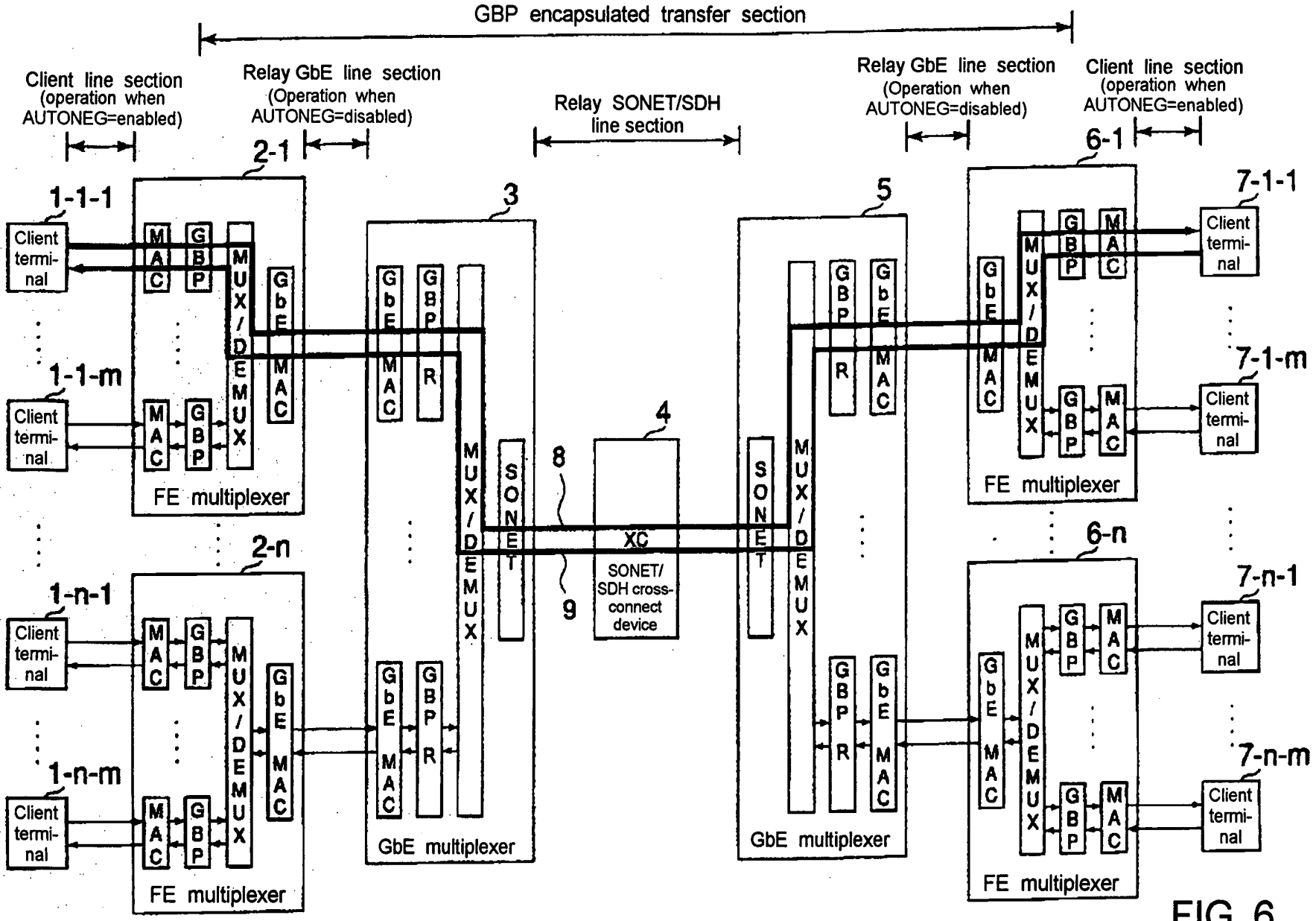

GBP encapsulated transfer section
Client line section (operation when AUTONEG=enabled)
Relay GbE line section (Operation when AUTONEG=disabled)
Relay SONET/SDH line section
Relay GbE line section (Operation when AUTONEG=disabled)
Client line section (operation when AUTONEG=enabled)
1-1-1
1-1-m
1-n-1
1-n-m
2-1
2-n
3
4
5
6-1
6-n
7-1-1
7-1-m
7-n-1
7-n-m
8
9
Client terminal
MAC
GBP
MUX/DEMUX
GbE MAC
SONET
XC
SONET/SDH cross-connect device
FE multiplexer
GbE multiplexer

FIG. 6

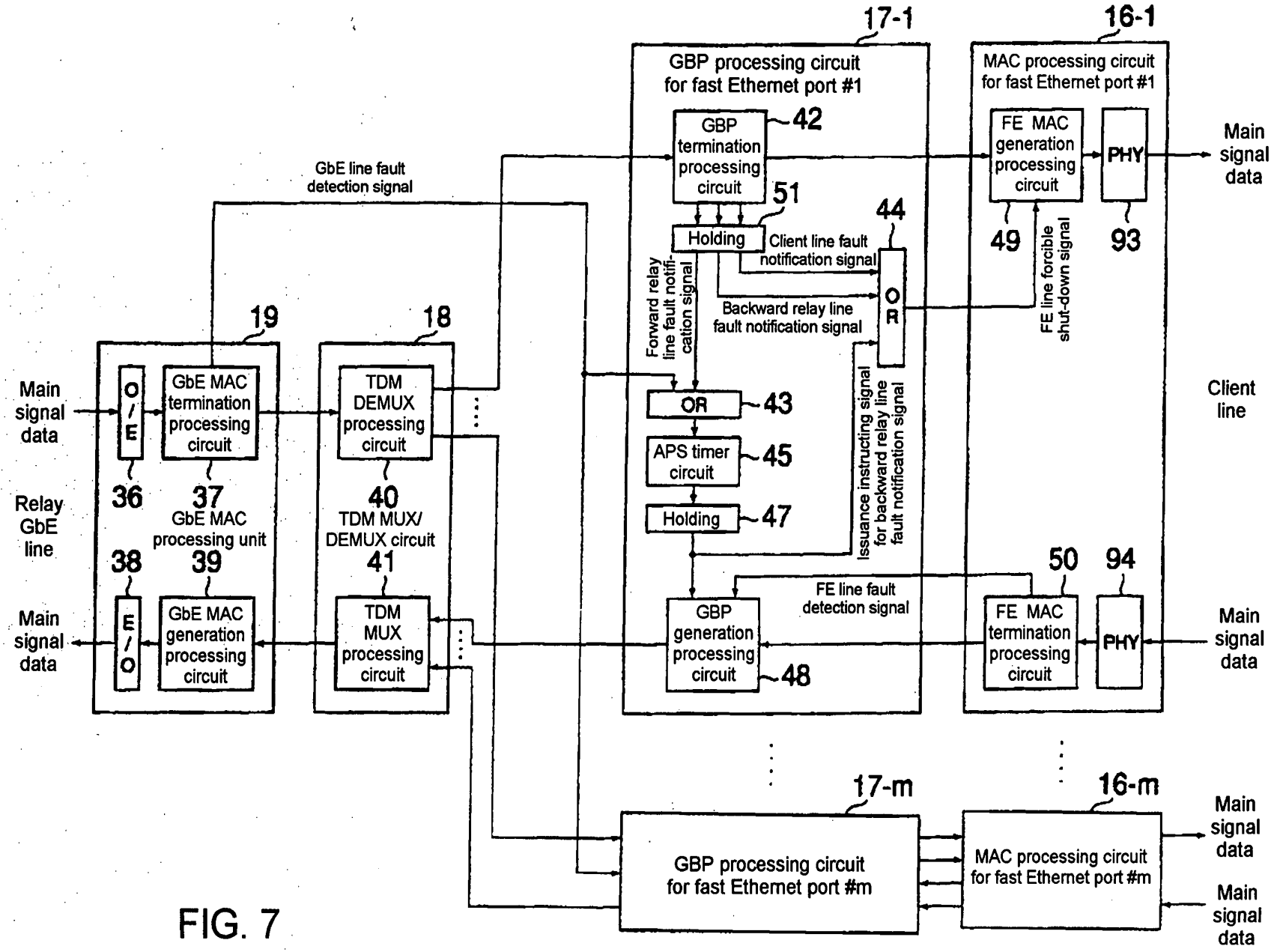

17-1
16-1
GBP processing circuit for fast Ethernet port #1
MAC processing circuit for fast Ethernet port #1
GBP termination processing circuit
42
FE MAC generation processing circuit
PHY
Main signal data
GbE line fault detection signal
51
44
Holding
Client line fault notification signal
Forward relay line fault notification signal
Backward relay line fault notification signal
OR
49
93
FE line forcible shut-down signal
19
18
Main signal data
O/E
GbE MAC termination processing circuit
TDM DEMUX processing circuit
Client line
OR
43
APS timer circuit
45
Holding
47
Issuance instructing signal for backward relay line fault notification signal
36
37
GbE MAC processing unit
40
TDM MUX/ DEMUX circuit
Relay GbE line
38
39
41
50
94
FE line fault detection signal
Main signal data
E/O
GbE MAC generation processing circuit
TDM MUX processing circuit
GBP generation processing circuit
48
FE MAC termination processing circuit
PHY
Main signal data
17-m
16-m
Main signal data
GBP processing circuit for fast Ethernet port #m
MAC processing circuit for fast Ethernet port #m
Main signal data

FIG. 7

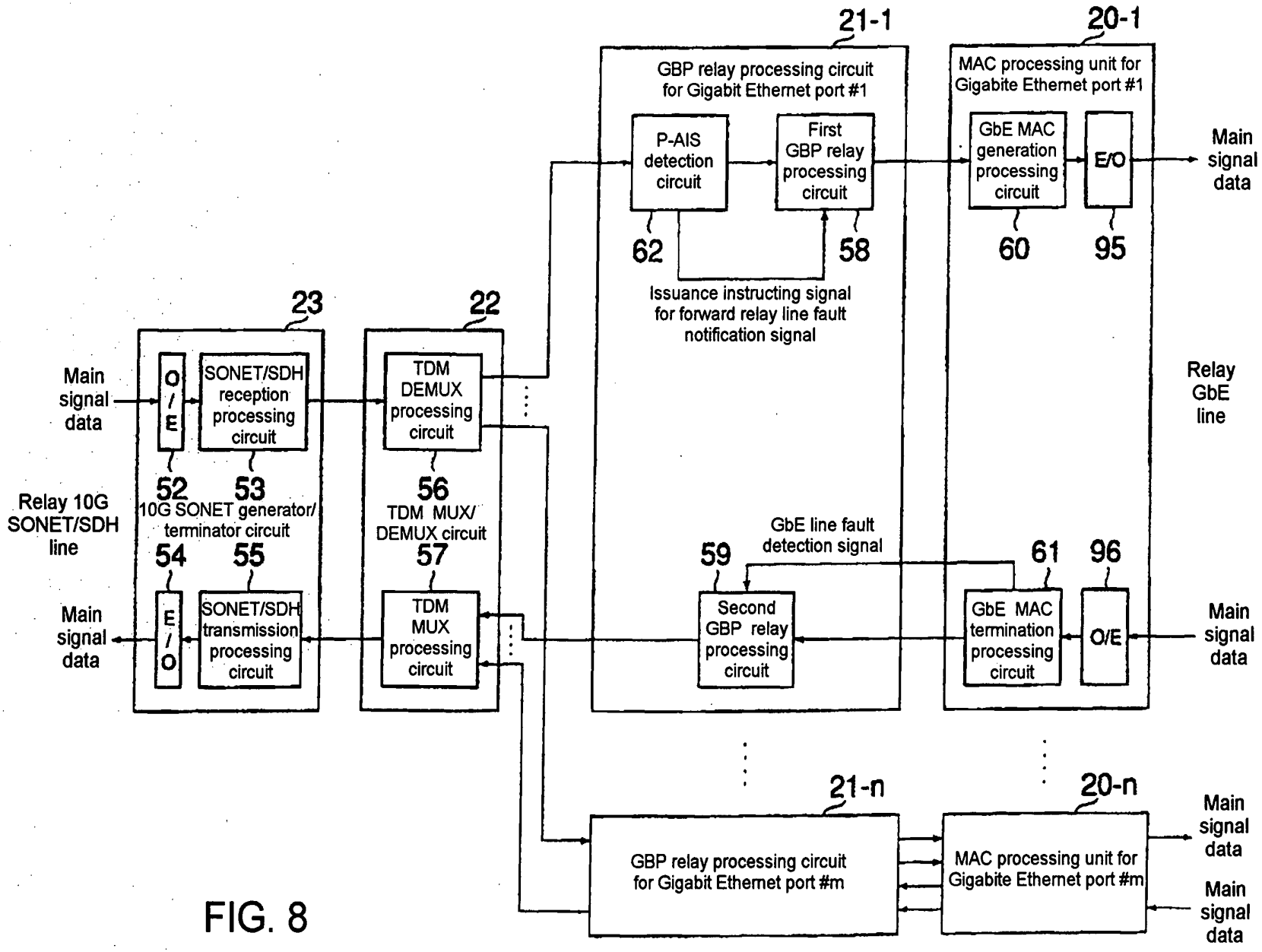

21-1
20-1
GBP relay processing circuit for Gigabit Ethernet port #1
MAC processing unit for Gigabite Ethernet port #1
P-AIS detection circuit
First GBP relay processing circuit
GbE MAC generation processing circuit
E/O
Main signal data
62
58
60
95
Issuance instructing signal for forward relay line fault notification signal
23
22
Main signal data
O/E
SONET/SDH reception processing circuit
TDM DEMUX processing circuit
Relay GbE line
52
53
56
Relay 10G SONET/SDH line
10G SONET generator/ terminator circuit
TDM MUX/ DEMUX circuit
GbE line fault detection signal
59
61
96
54
55
57
Main signal data
E/O
SONET/SDH transmission processing circuit
TDM MUX processing circuit
Second GBP relay processing circuit
GbE MAC termination processing circuit
O/E
Main signal data
21-n
20-n
GBP relay processing circuit for Gigabit Ethernet port #m
MAC processing unit for Gigabite Ethernet port #m
Main signal data
Main signal data

FIG. 8

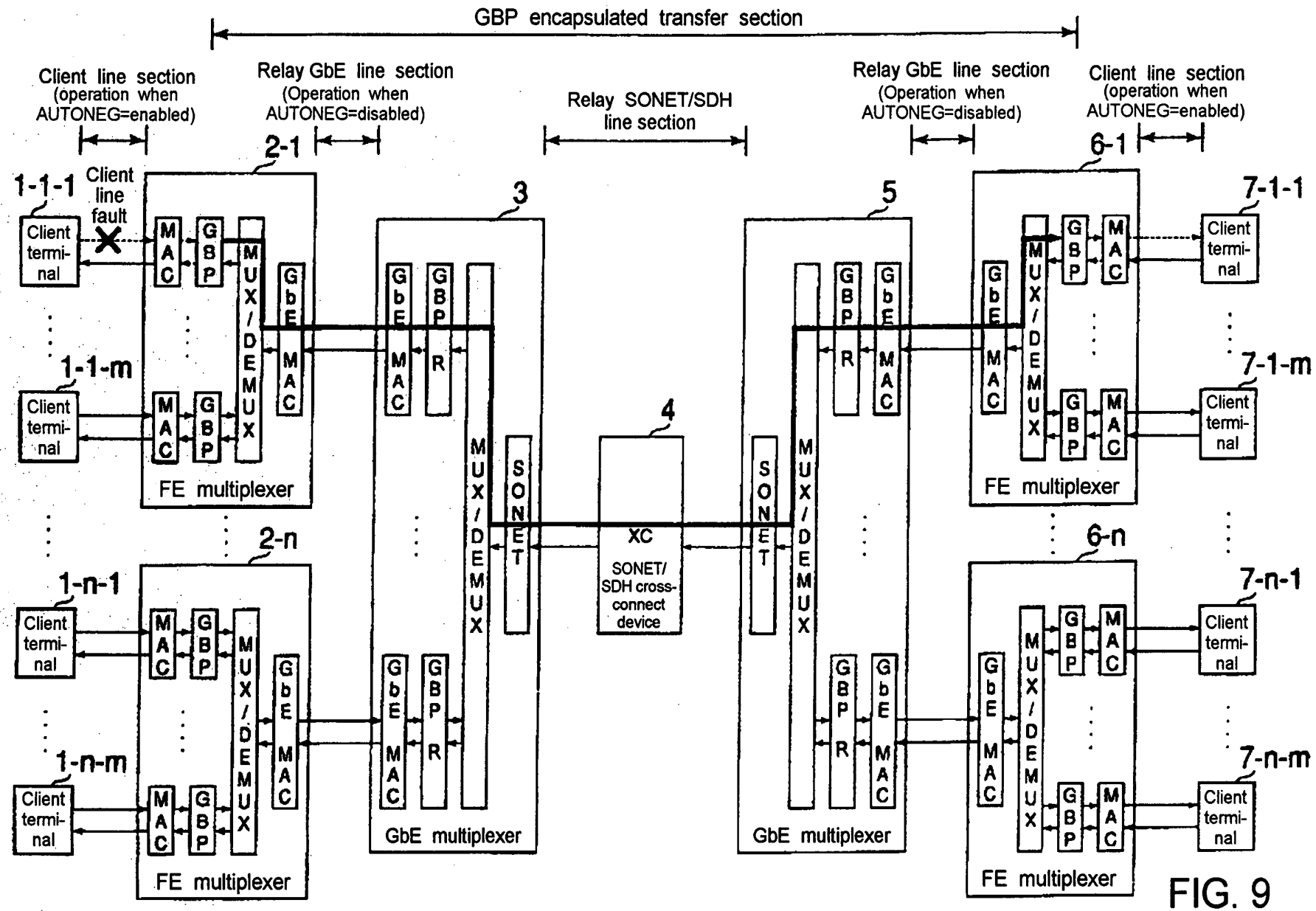

GBP encapsulated transfer section
Client line section (operation when AUTONEG=enabled)
Relay GbE line section (Operation when AUTONEG=disabled)
Relay SONET/SDH line section
Relay GbE line section (Operation when AUTONEG=disabled)
Client line section (operation when AUTONEG=enabled)
1-1-1
Client terminal
Client line fault
1-1-m
1-n-1
1-n-m
2-1
2-n
FE multiplexer
3
GbE multiplexer
4
XC
SONET/ SDH cross-connect device
5
6-1
6-n
7-1-1
7-1-m
7-n-1
7-n-m
MAC
GBP
MUX/DEMUX
GbE MAC
SONET

FIG. 9

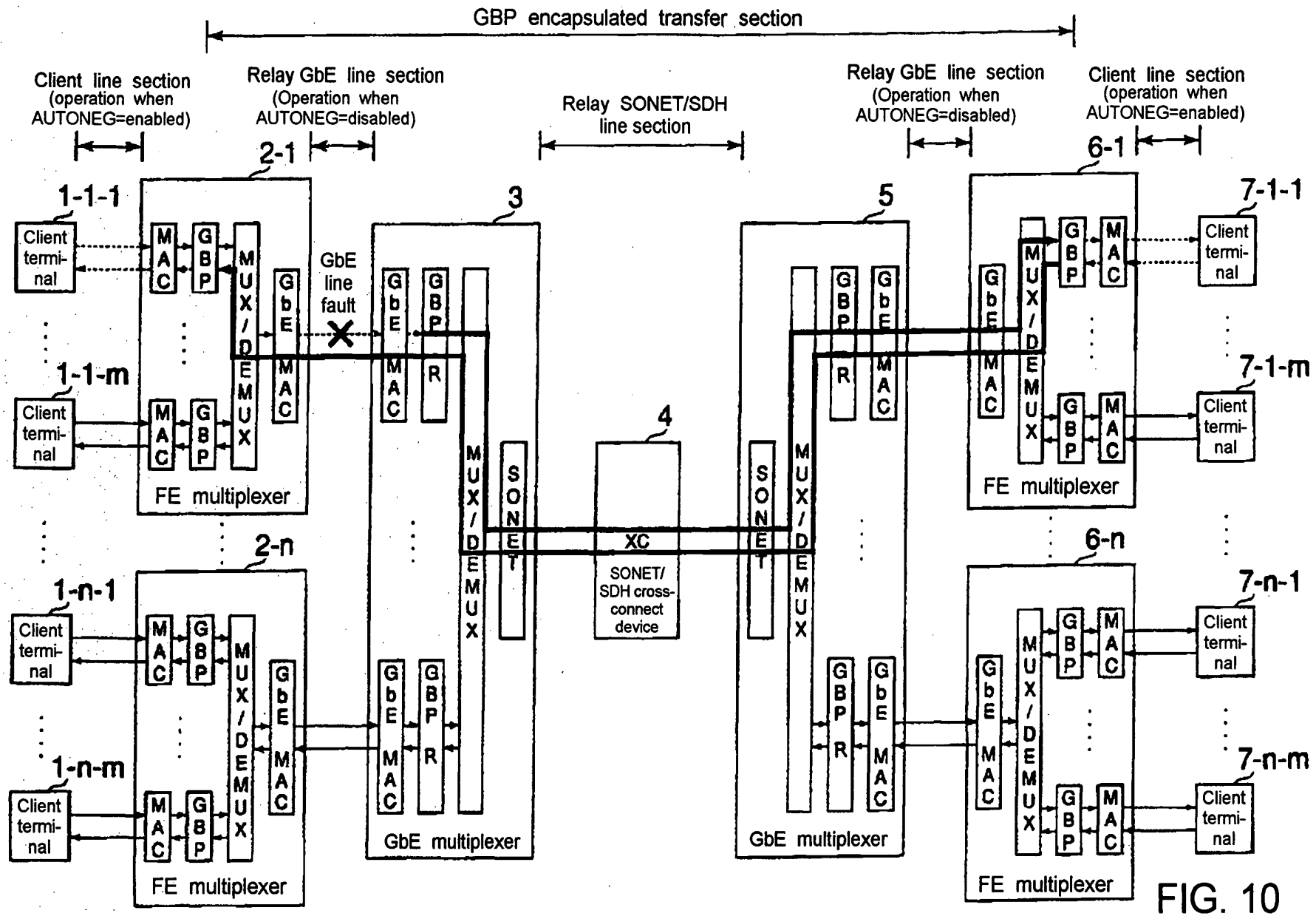

GBP encapsulated transfer section
Client line section (operation when AUTONEG=enabled)
Relay GbE line section (Operation when AUTONEG=disabled)
Relay SONET/SDH line section
Relay GbE line section (Operation when AUTONEG=disabled)
Client line section (operation when AUTONEG=enabled)
1-1-1
1-1-m
1-n-1
1-n-m
2-1
2-n
3
4
5
6-1
6-n
7-1-1
7-1-m
7-n-1
7-n-m
Client terminal
MAC
GBP
MUX/DEMUX
GbE MAC
GbE line fault
GBPR
SONET
XC
SONET/SDH cross-connect device
FE multiplexer
GbE multiplexer

FIG. 10

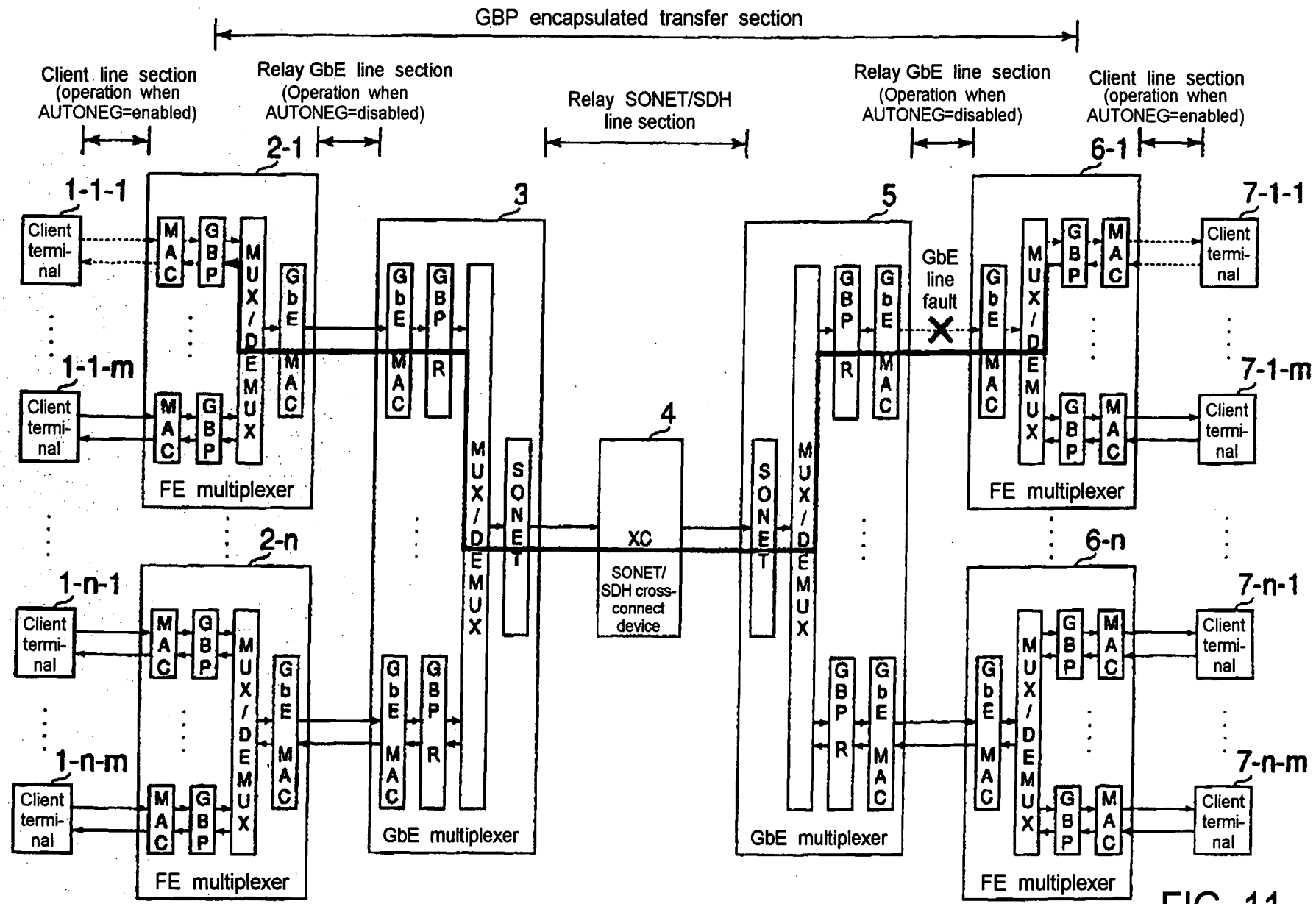

GBP encapsulated transfer section
Client line section (operation when AUTONEG=enabled)
Relay GbE line section (Operation when AUTONEG=disabled)
Relay SONET/SDH line section
Relay GbE line section (Operation when AUTONEG=disabled)
Client line section (operation when AUTONEG=enabled)
1-1-1
1-1-m
1-n-1
1-n-m
2-1
2-n
3
4
5
6-1
6-n
7-1-1
7-1-m
7-n-1
7-n-m
Client terminal
MAC
GBP
MUX/DEMUX
GbE MAC
SONET
XC
SONET/SDH cross-connect device
GbE line fault
FE multiplexer
GbE multiplexer

FIG. 11

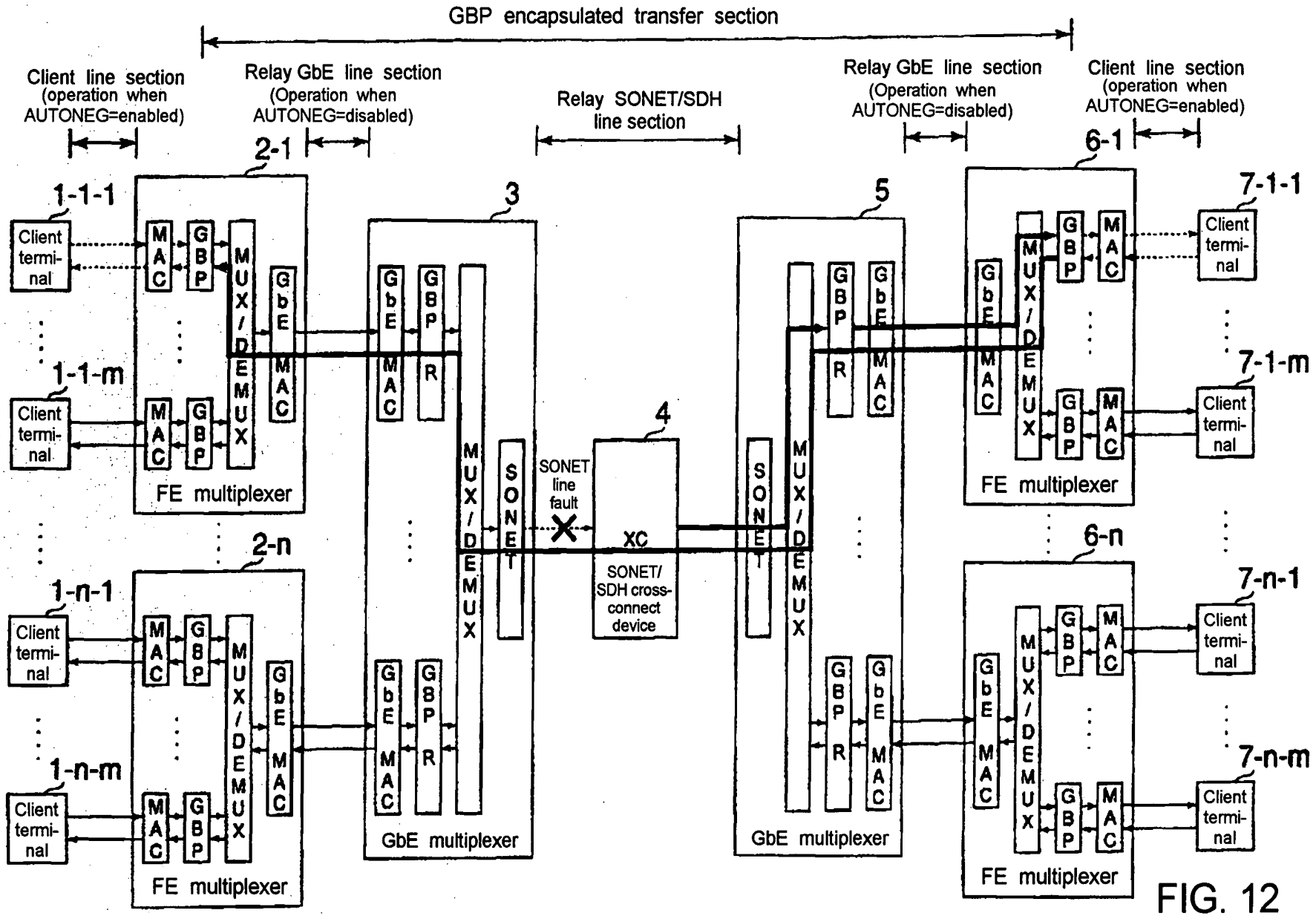

GBP encapsulated transfer section
Client line section (operation when AUTONEG=enabled)
Relay GbE line section (Operation when AUTONEG=disabled)
Relay SONET/SDH line section
Relay GbE line section (Operation when AUTONEG=disabled)
Client line section (operation when AUTONEG=enabled)
1-1-1
1-1-m
1-n-1
1-n-m
2-1
2-n
3
4
5
6-1
6-n
7-1-1
7-1-m
7-n-1
7-n-m
Client terminal
MAC
GBP
MUX/DEMUX
GbE MAC
GBP R
SONET
SONET line fault
XC
SONET/SDH cross-connect device
FE multiplexer
GbE multiplexer

FIG. 12

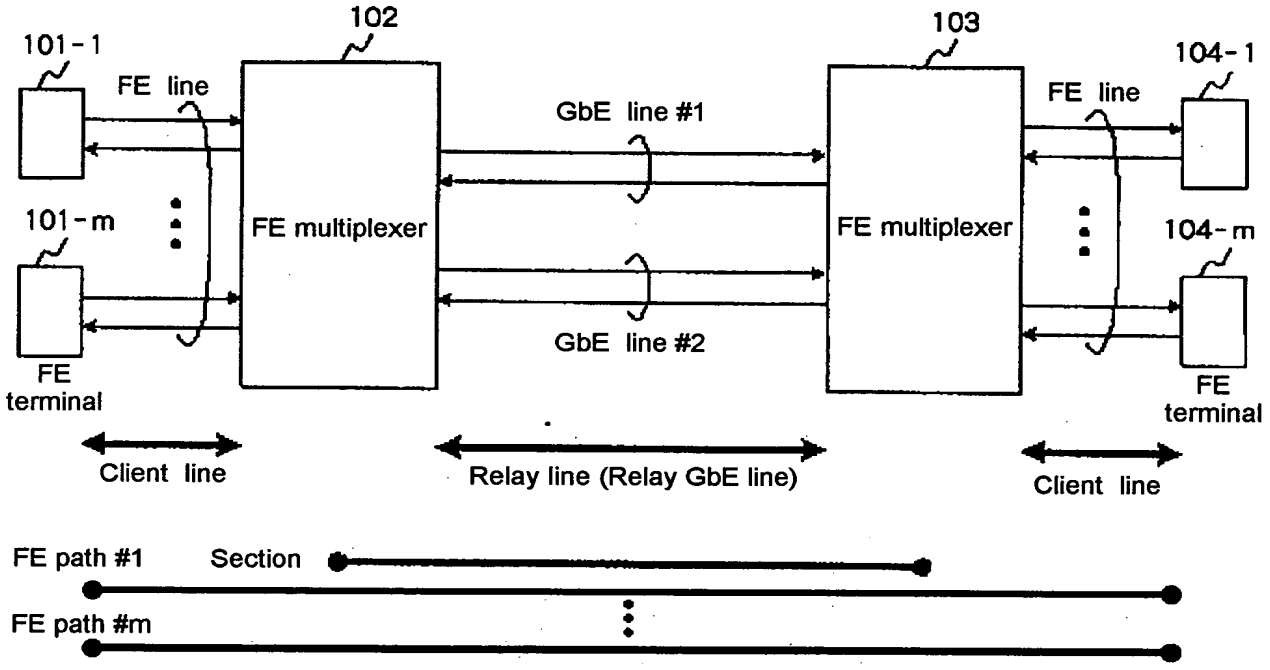

101-1
FE line
102
GbE line #1
103
104-1
FE line
101-m
FE multiplexer
FE multiplexer
104-m
GbE line #2
FE terminal
FE terminal
Client line
Relay line (Relay GbE line)
Client line
FE path #1
Section
FE path #m

FIG. 13

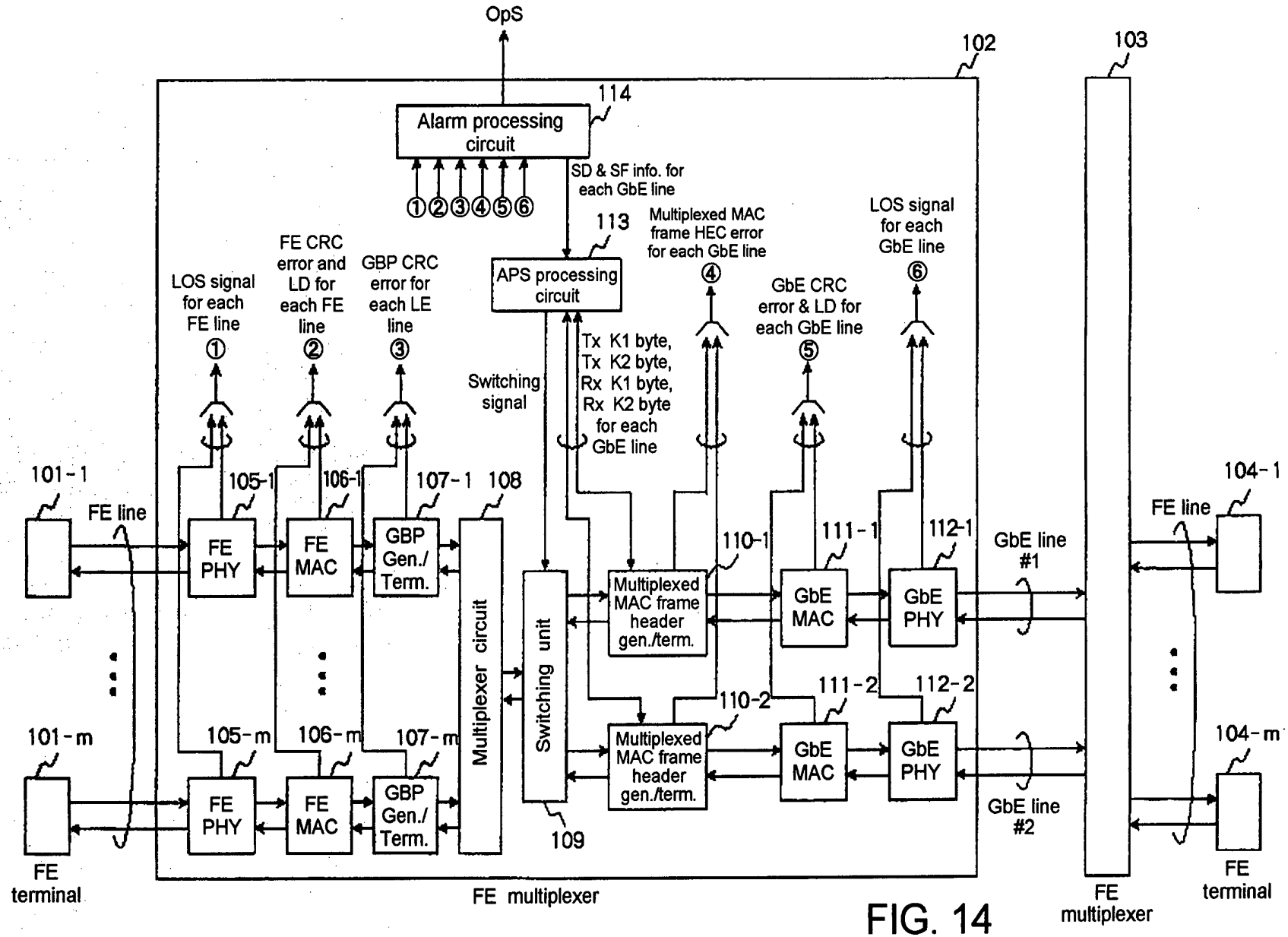

OpS
102
103
114
Alarm processing circuit
SD & SF info. for each GbE line
①②③④⑤⑥
113
APS processing circuit
Multiplexed MAC frame HEC error for each GbE line
④
LOS signal for each GbE line
⑥
LOS signal for each FE line
①
FE CRC error and LD for each FE line
②
GBP CRC error for each LE line
③
GbE CRC error & LD for each GbE line
⑤
Switching signal
Tx K1 byte, Tx K2 byte, Rx K1 byte, Rx K2 byte for each GbE line
101-1
FE line
105-1
106-1
107-1
108
FE PHY
FE MAC
GBP Gen./ Term.
Multiplexer circuit
Switching unit
109
110-1
Multiplexed MAC frame header gen./term.
111-1
GbE MAC
112-1
GbE PHY
GbE line #1
104-1
FE line
101-m
105-m
106-m
107-m
110-2
111-2
112-2
104-m
GbE line #2
FE terminal
FE multiplexer
FE multiplexer
FE terminal

FIG. 14

Content	Detecting condition	Releasing condition	Unit of detection	Remarks	Judgment for switching
Interruption of FE input	Interruption of FE signal input	Recovery of FE signal input	Each FE path	-	-
FE link-down	Detection of FE link-down	Recovery from FE link-down	Each FE path	-	-
Abnormal multiplexed reception	Detection of "1" in forward relay line fault notification in GBP transport header of GBP capsule	Detection of "0" in forward relay line fault notification in GBP transport header of GBP capsule for a fixed time period	Each FE path	Corresponding to path AIS of SDH (HP-AIS)	-
Error in multiplexed reception data	Detection of CRC error in GBP capsule	No detection of CRC error in GBP capsule	Each FE path	Corresponding to B3 errer of SDH (HP-BIP error)	-
Interruption of opposing side link	Detection of "1" in client line fault notification in type field of GBP core block of GBP capsule	Detection of "0" in client line fault notification in type field of GBP core block of GBP capsule	Each FE path	-	-
Abnormal transmission path	Detection of "1" in backward relay line fault notification in GBP transport header of GBP capsule	Detection of "0" in backward relay line fault notification in GBP transport header of GBP capsule	Each FE path	Corresponding to path RDI of SDH (HP-RDI)	-
GBP capsule SD	CRC error rate of GBP capsule is in range of 10e-3 to 10e-6	Release when value is at 1/10 of error rate previously set	Each FE path	Corresponding to deterioration in B3 error rate of SDH (P-SD)	-
Deterioration in error rate of GbE	GbE multiplexed reception error rate is in range of 10e-3 to 10e-7	Release when value is at 1/10 of error rate previously set	Each GbE line (Each section)	Corresponding to deterioration in B2 error rate of SDH (SD)	SD
Data error in GbE multiplexed reception	Detection of FCS error of GbE or detection of multiplexed MAC frame header HEC error	No detection of FCS error of GbE or no detection of multiplexed MAC frame header HEC error	Each GbE line (Each section)	Corresponding to B2 error of SDH (MS-BIP error)	SF
Abnormal APS byte	K1 & K2 do not coincide for consecutive three times for a fixed period or K1 includes undefined pattern	Recovery from the detection condition listed left	Each GbE line (Each section)	Corresponding to PSBF of SDH	SF
Interruption of GbE optical input	Interruption of GbE optical input	Recovery of GbE optical input	Each GbE line (Each section)	Corresponding to LOS of SDH	SF
GbE link-down	Detection of GbE link-down	Recovery from GbE link-down	Each GbE line (Each section)	Corresponding to LOS of SDH	SF

FIG. 15

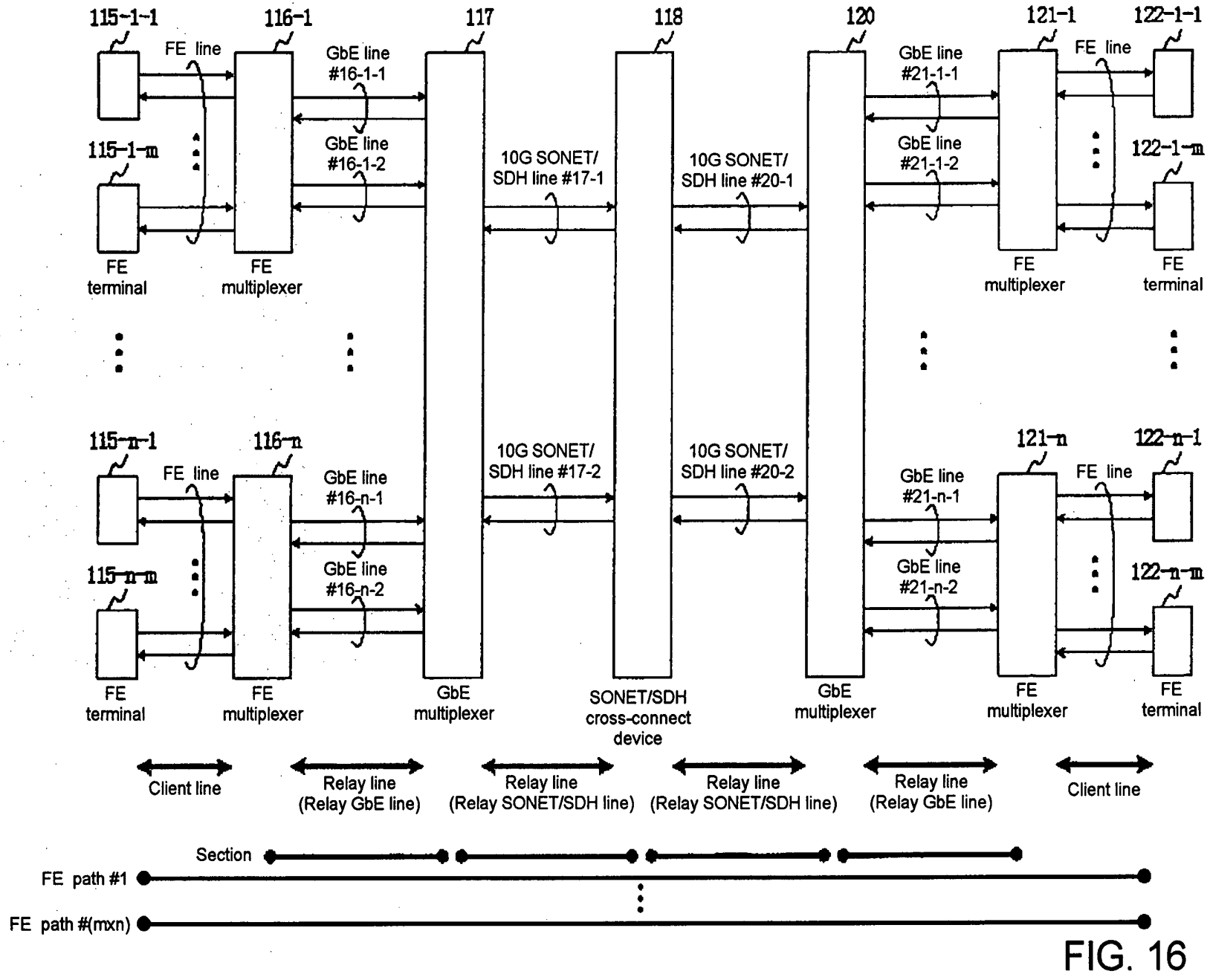

115-1-1
116-1
117
118
120
121-1
122-1-1
FE line
GbE line #16-1-1
GbE line #16-1-2
10G SONET/ SDH line #17-1
10G SONET/ SDH line #20-1
GbE line #21-1-1
GbE line #21-1-2
FE line
115-1-m
122-1-m
FE terminal
FE multiplexer
FE multiplexer
FE terminal
115-n-1
116-n
121-n
122-n-1
10G SONET/ SDH line #17-2
10G SONET/ SDH line #20-2
GbE line #16-n-1
GbE line #16-n-2
GbE line #21-n-1
GbE line #21-n-2
115-n-m
122-n-m
FE terminal
FE multiplexer
GbE multiplexer
SONET/SDH cross-connect device
GbE multiplexer
FE multiplexer
FE terminal
Client line
Relay line (Relay GbE line)
Relay line (Relay SONET/SDH line)
Relay line (Relay SONET/SDH line)
Relay line (Relay GbE line)
Client line
Section
FE path #1
FE path #(mxn)

FIG. 16

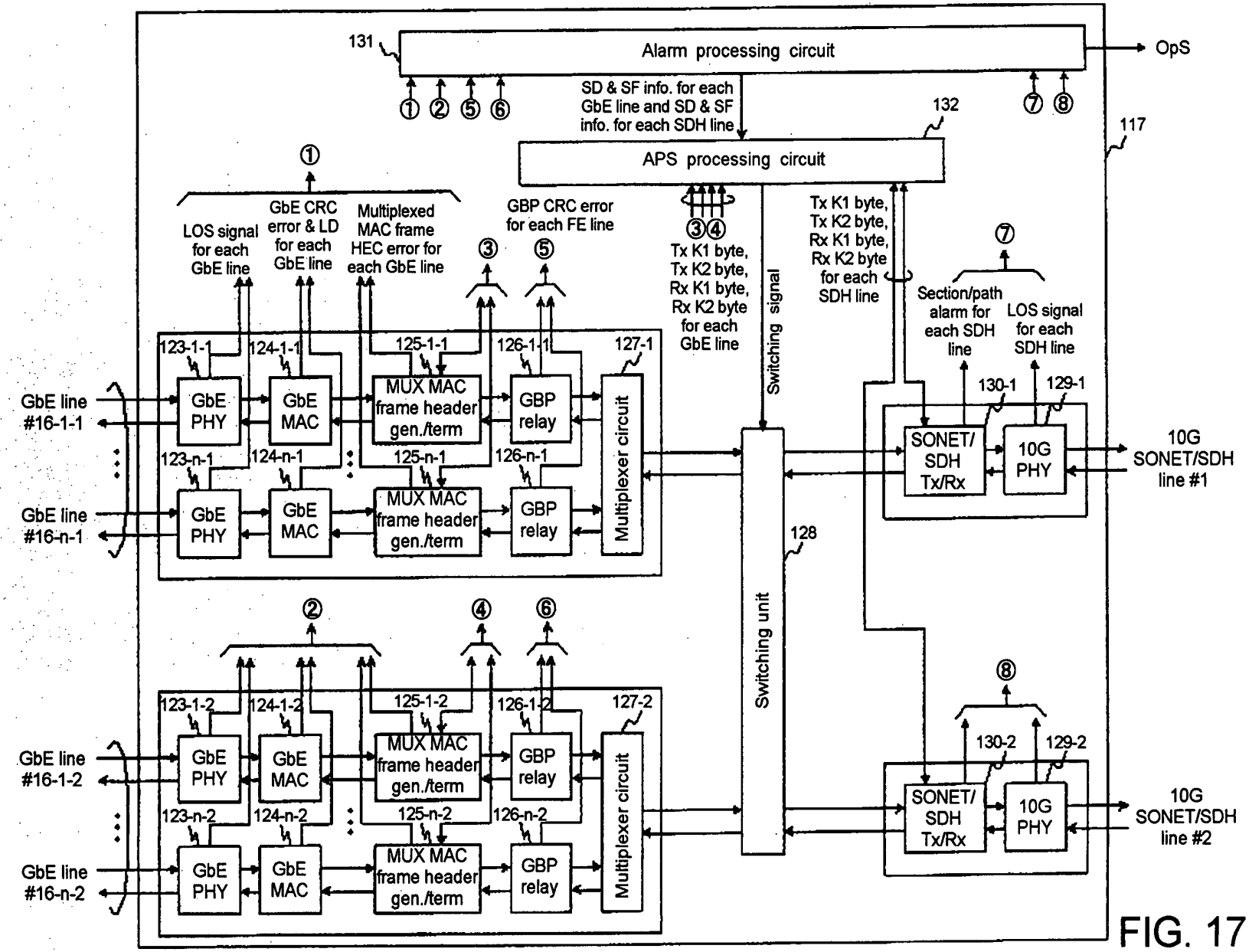

131
Alarm processing circuit
OpS
SD & SF info. for each GbE line and SD & SF info. for each SDH line
132
APS processing circuit
117
LOS signal for each GbE line
GbE CRC error & LD for each GbE line
Multiplexed MAC frame HEC error for each GbE line
GBP CRC error for each FE line
Tx K1 byte, Tx K2 byte, Rx K1 byte, Rx K2 byte for each GbE line
Switching signal
Tx K1 byte, Tx K2 byte, Rx K1 byte, Rx K2 byte for each SDH line
Section/path alarm for each SDH line
LOS signal for each SDH line
GbE line #16-1-1
GbE line #16-n-1
GbE line #16-1-2
GbE line #16-n-2
GbE PHY
GbE MAC
MUX MAC frame header gen./term
GBP relay
Multiplexer circuit
123-1-1
124-1-1
125-1-1
126-1-1
127-1
123-n-1
124-n-1
125-n-1
126-n-1
123-1-2
124-1-2
125-1-2
126-1-2
127-2
123-n-2
124-n-2
125-n-2
126-n-2
Switching unit
128
SONET/ SDH Tx/Rx
10G PHY
130-1
129-1
130-2
129-2
10G SONET/SDH line #1
10G SONET/SDH line #2

FIG. 17

Content	Detecting condition	Releasing condition	Unit of detection	Remarks	Judgment for switching
Interruption of GbE optical input	Interruption of GbE optical input	Recovery of GbE optical input	Each GbE line (Each section)	Corresponding to LOS of SDH	SF
GbE link-down	Detection of GbE link-down	Recovery from GbE link-down	Each GbE line (Each section)	Corresponding to LOS of SDH	SF
Abnormal multiplexed reception	H1/H2 bytes of VC-4 are all "1" for consecutive three frames	H1/H2 bytes of VC-4 are not all "1" (No protection)			
Abnormal multiplexed reception (Monitor)	Detection of "1" in forward relay line fault notification in GBP transport header of GBP capsule	Detection of "0" in forward relay line fault notification in GBP transport header of GBP capsule for a fixed time period	Each FE path	Corresponding to monitoring path AIS of SDH (HP-AIS)	-
Error in multiplexed reception data (Monitor)	Detection of CRC error in GBP capsule	No detection of CRC error in GBP capsule	Each FE path	Corresponding to monitoring B3 errer of SDH (HP-BIP error)	-
Interruption of opposing side link (Monitor)	Detection of "1" in client line fault notification In type field of GBP core block of GBP capsule	Detection of "0" in client line fault notification In type field of GBP core block of GBP capsule	Each FE path	-	-
Abnormal transmission path (Monitor)	Detection of "1" in backward relay line fault notification in GBP transport header of GBP capsule	Detection of "0" in backward relay line fault notification in GBP transport header of GBP capsule	Each FE path	Corresponding to monitoring path RDI of SDH (HP-RDI)	-
GBP capsule SD (Monitor)	CRC error rate of GBP capsule is in range of 10e-3 to 10e-6	Release when value is at 1/10 of error rate previously set	Each FE path	Corresponding to monitoring deterioration in B3 error rate of SDH (P-SD)	-
Deterioration in error rate in GbE	GbE multiplexed reception error rate is in range of 10e-3 to 10e-7	Release when value is at 1/10 of error rate previously set	Each GbE line (Each section)	Corresponding to deterioration in B2 error rate of SDH (SD)	SD
Data error in GbE multiplexed reception	Detection of FCS error of GbE or detection of multiplexed MAC frame header HEC error	No detection of FCS error of GbE or no detection of multiplexed MAC frame header HEC error	Each GbE line (Each section)	Corresponding to B2 error of SDH (MS-BIP error)	SF
Abnormal APS byte	K1 & K2 do not coincide for consecutive three times for a fixed period or K1 includes undefined pattern	Recovery from the detection condition listed left	Each GbE line, each SDH line (Each section)		SF
SDH path alarm	Depending on detection condition of each POH byte error	Depending on releasing condition of each POH byte error	Each FE path		SF
SDH section alarm	Depending on detection condition of each SOH byte error	Depending on releasing condition of each SOH byte error	Each SDH line (Each section)		SF (SD for B2 error rate deterioration
Interrupt of SDH optical input	Interrupt of optical input	Recovery of optical input	Each SDH line (Each section)		SF

FIG. 18